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(54) Metering dispenser for viscous fluids

(57) The metering dispenser for dispensing a metered dose of a viscous fluid, such as a medicinal cream, has a dispensing passage 50 attached to which is an indicating element 54 for giving an indication of the quantity of fluid dispensed. The indicating element has a number of radial vanes 55 and is rotatably attached to the dispensing passage by a central spindle 57 engaged in a socket 52. The periphery of the indicating element 54 has a plurality of marks 56 while the neck 51 of the dispensing passage 50 has a single fixed reference mark 58. When fluid is dispensed from the dispenser it passes through the indicating element 54 and the flow passing the vanes 55 imparts a force on the vanes 55 which causes the indicating element 54 to rotate. The amount of fluid dispensed can be assessed from the number of marks 56 on the periphery of the indicating element 54 which have passed the fixed reference mark 58 during dispensing.

FIGURES 5

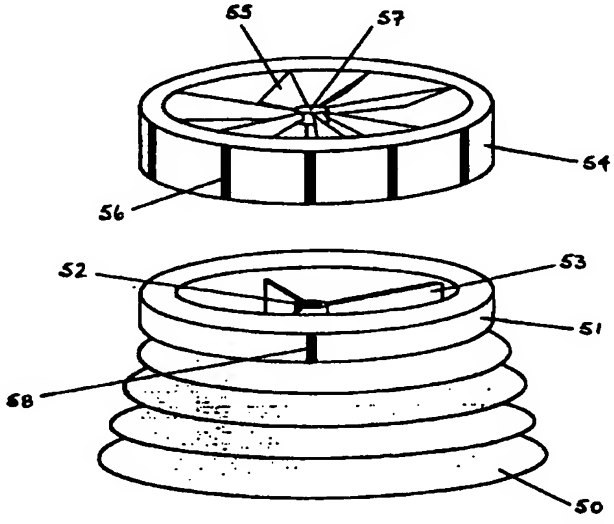

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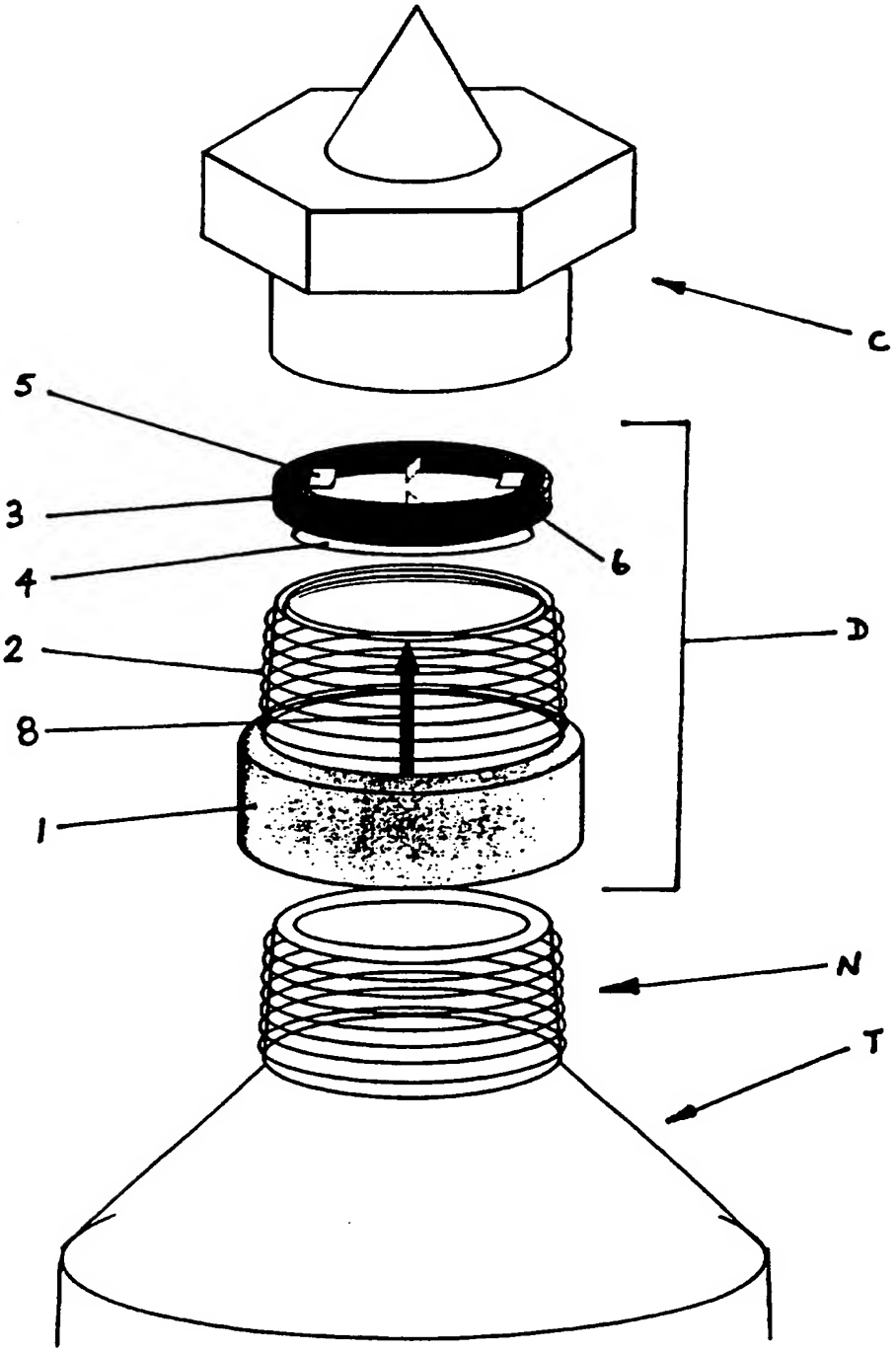
FIGURE 1



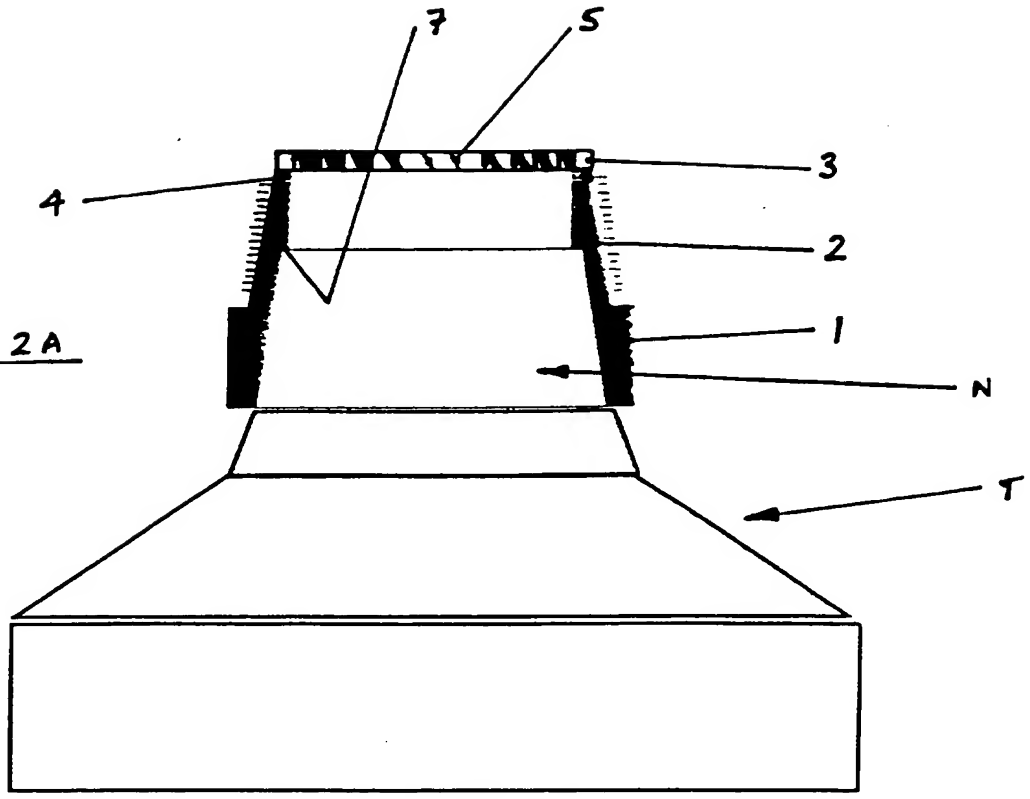


FIGURE 2A

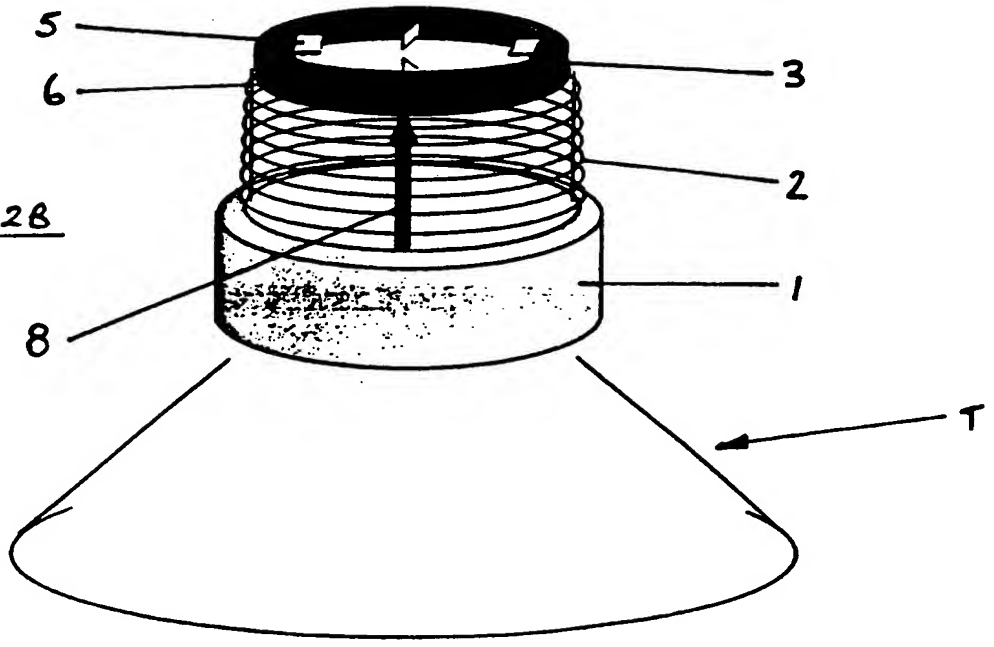


FIGURE 2B

FIGURE 3

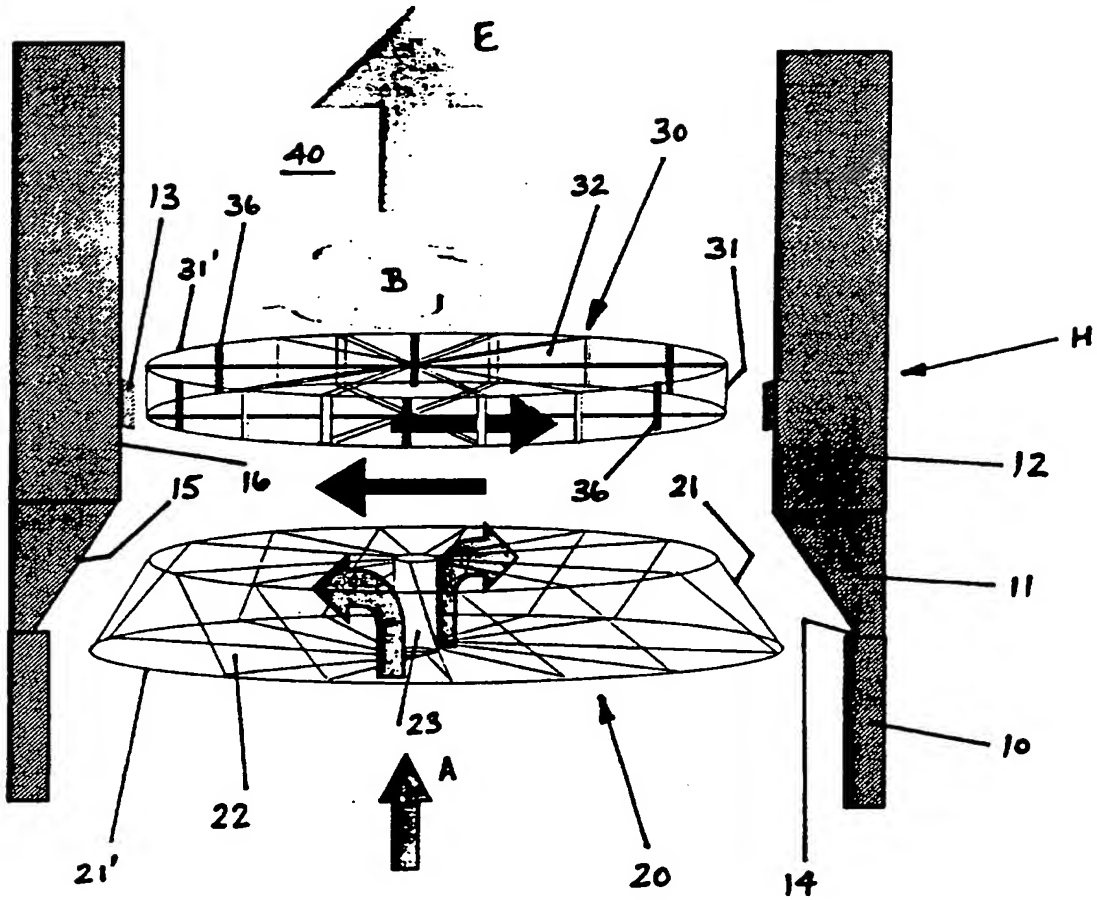


FIGURE 4A

FIGURE 4B

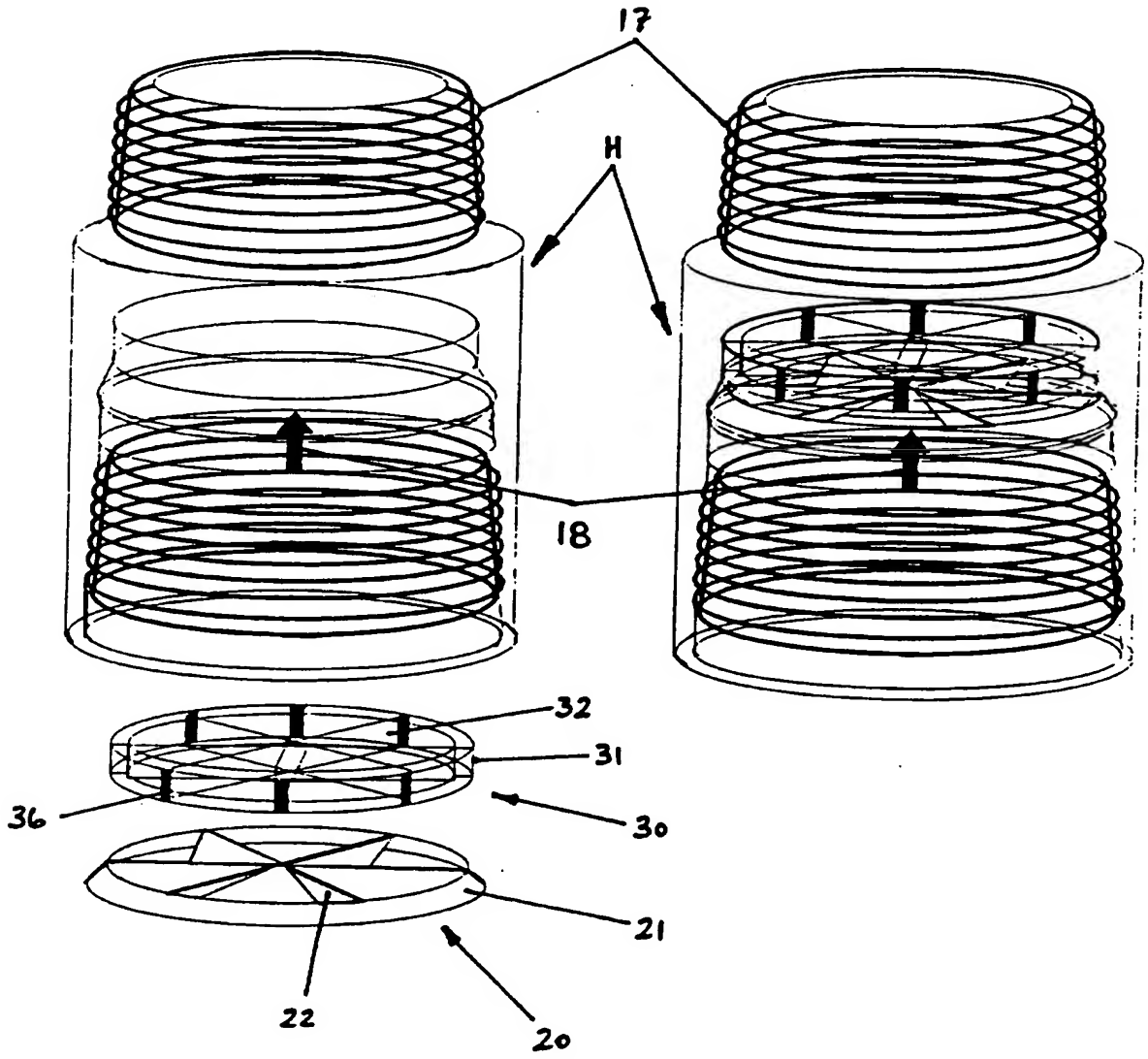
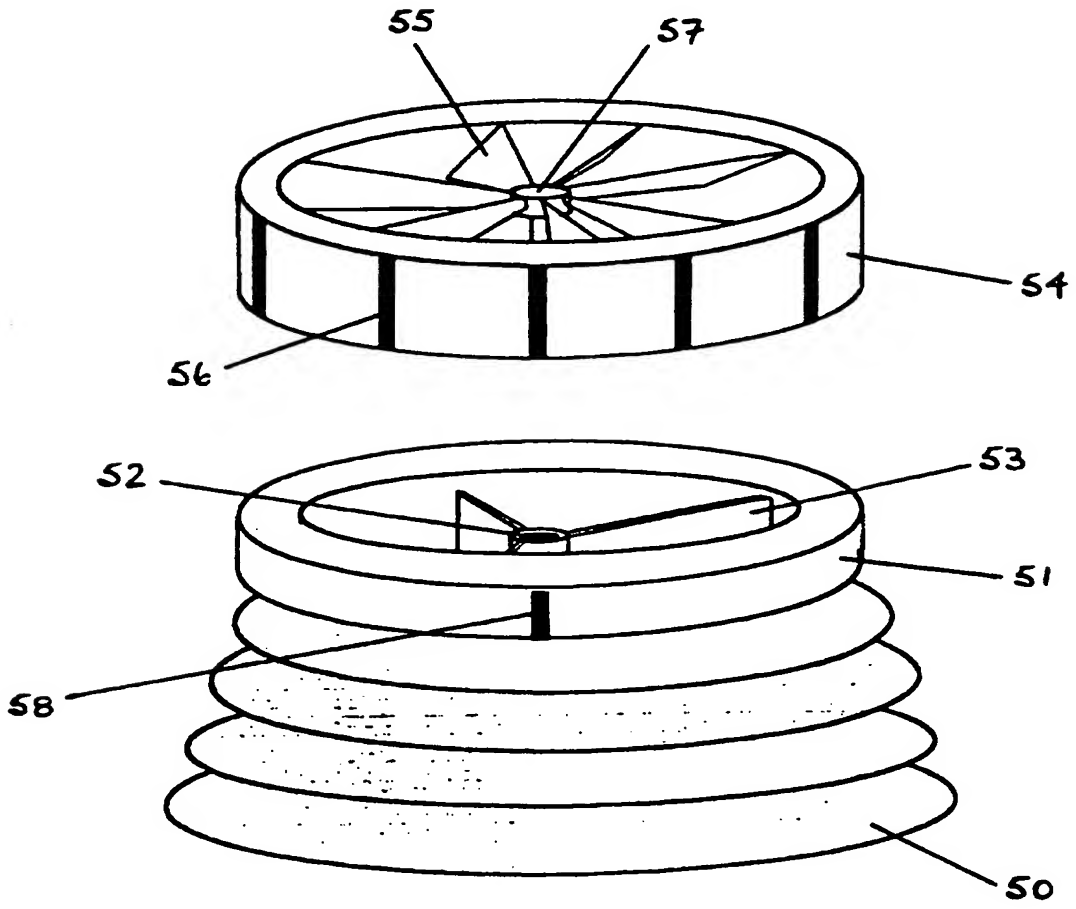


FIGURE 5



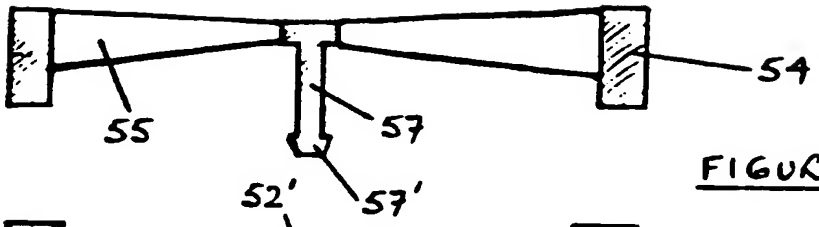
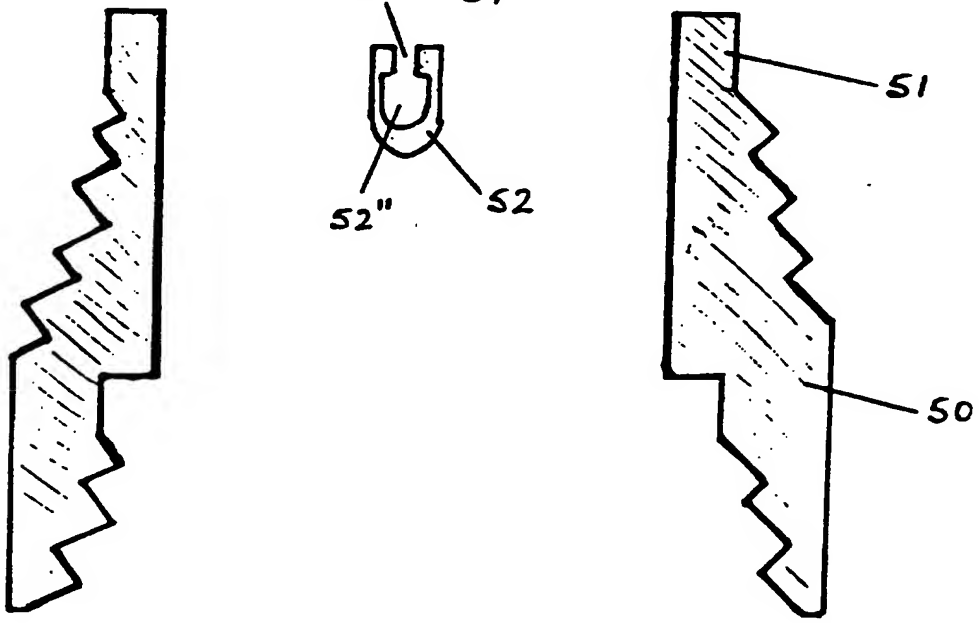


FIGURE 6



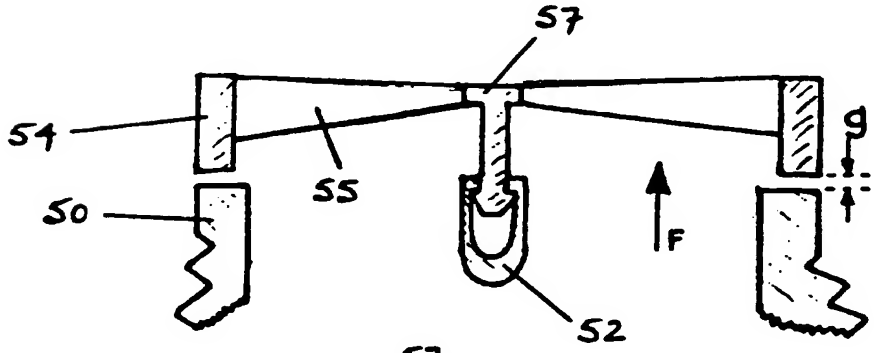


FIGURE 7A

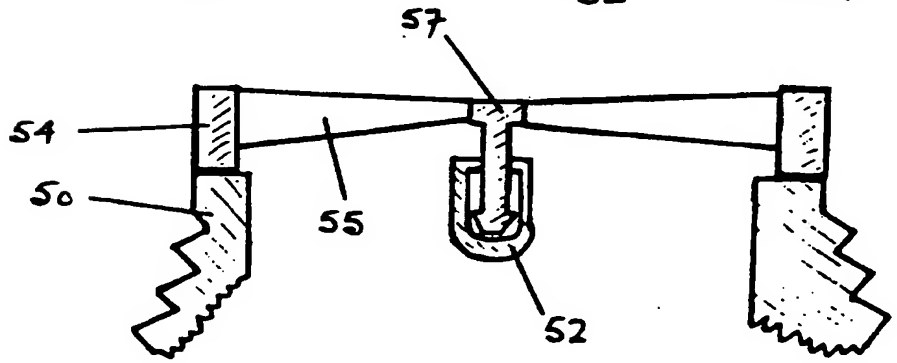


FIGURE 7B

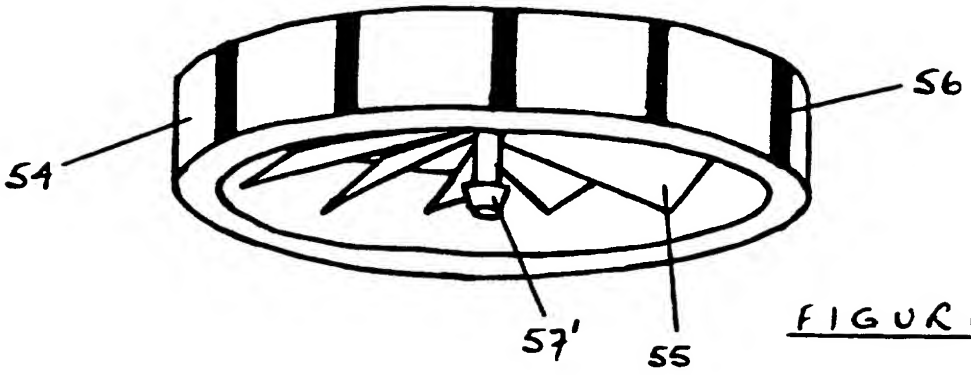


FIGURE 8

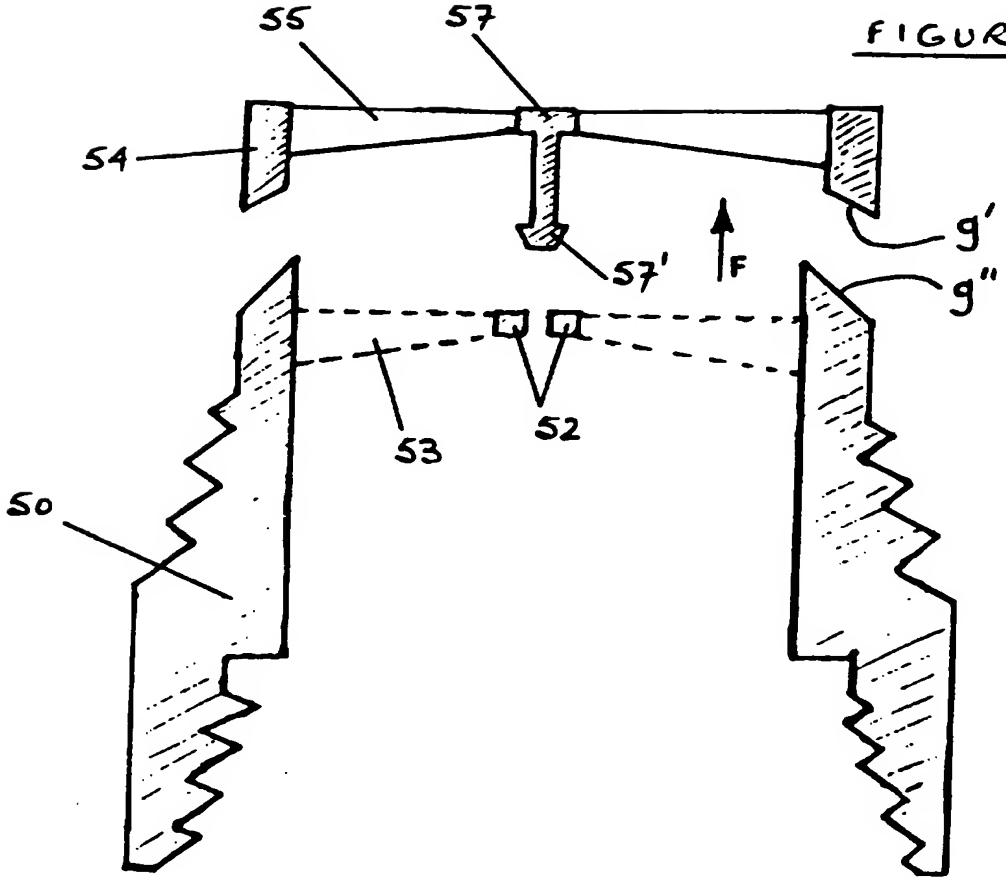


FIGURE 9

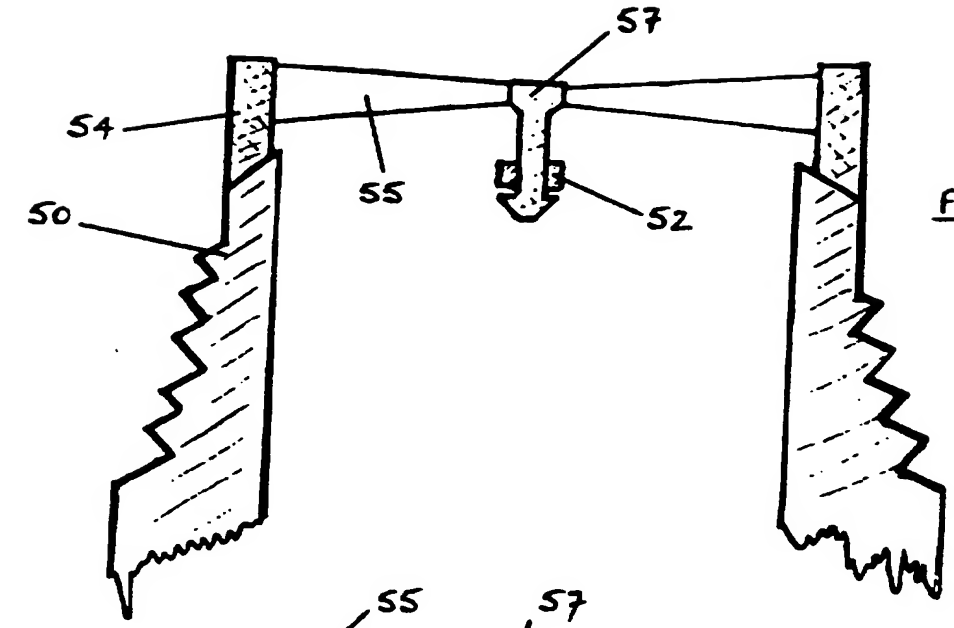


FIGURE 10A

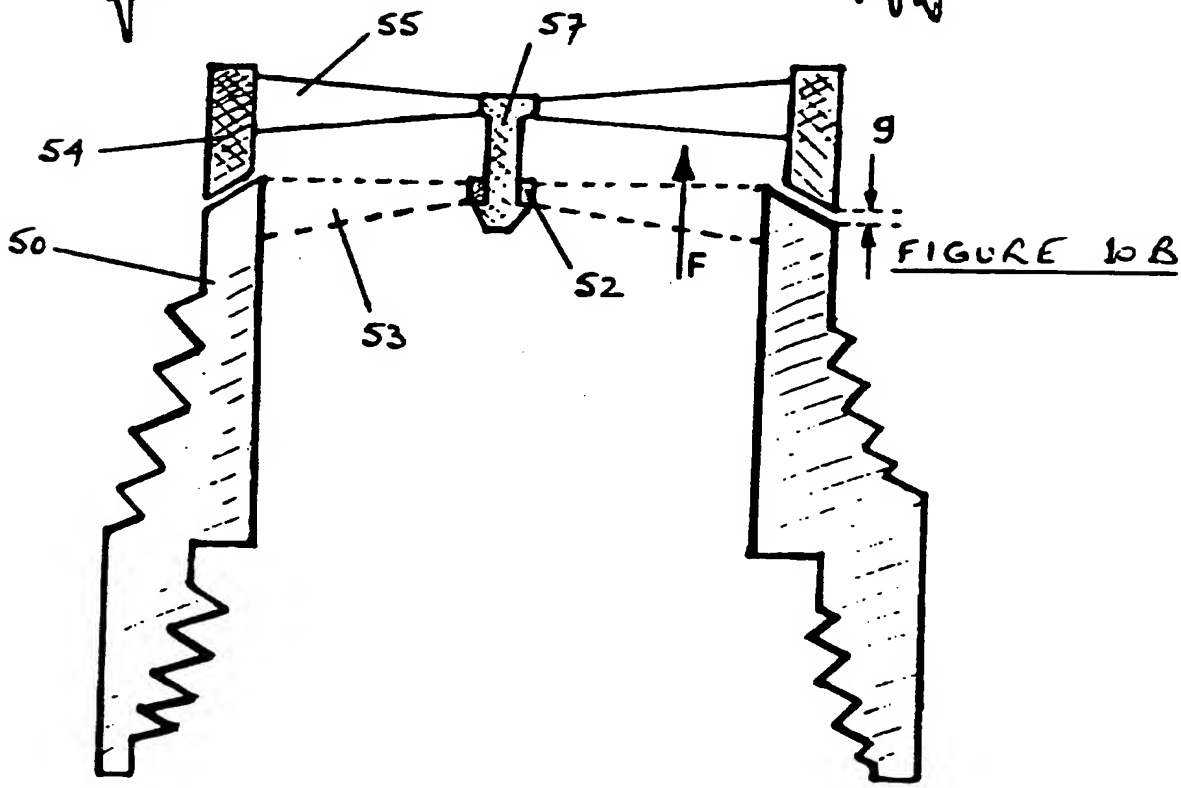


FIGURE 10B

FIGURE 11

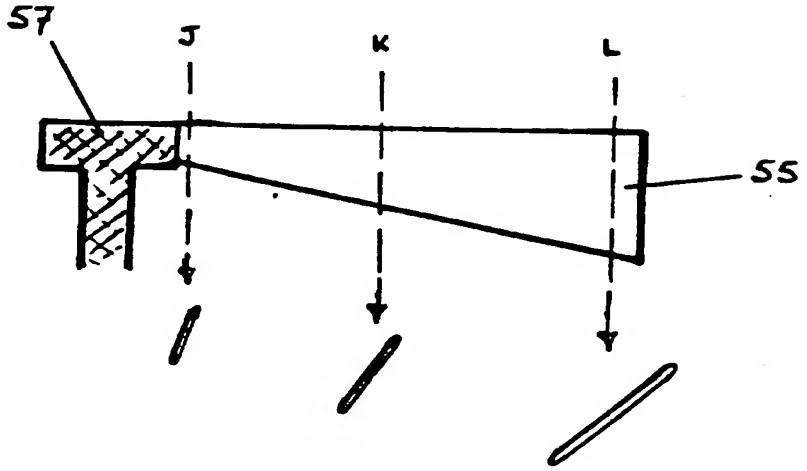
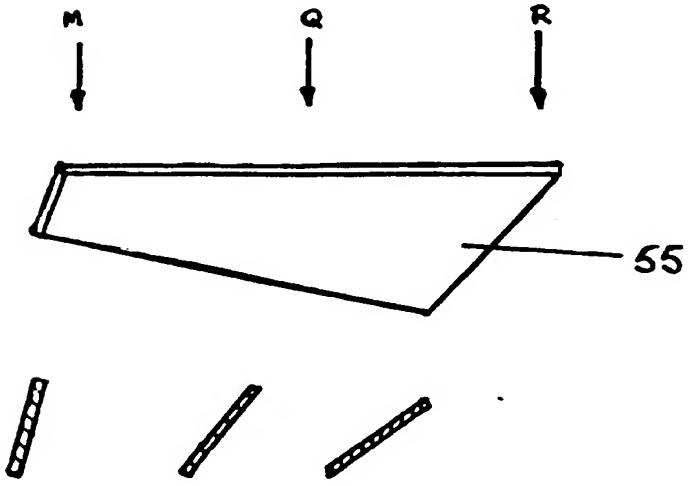


FIGURE 12



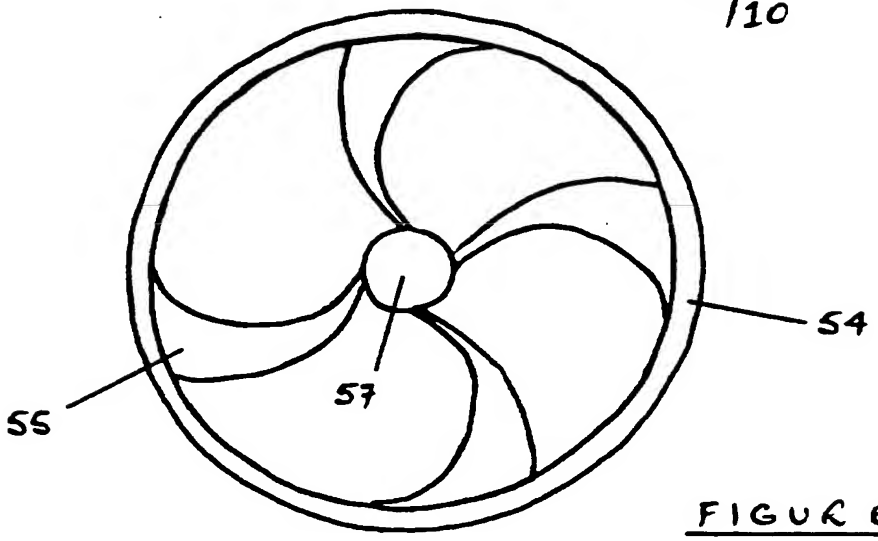


FIGURE 13

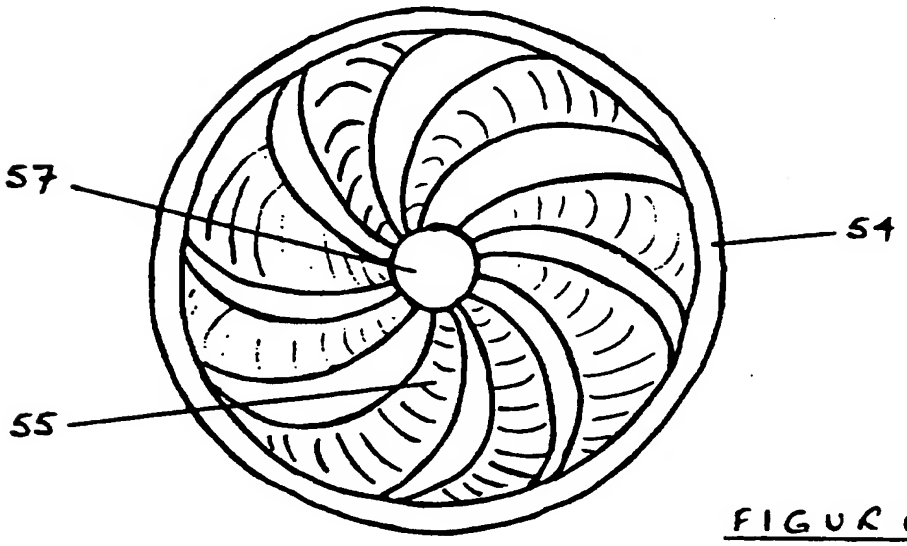


FIGURE 14

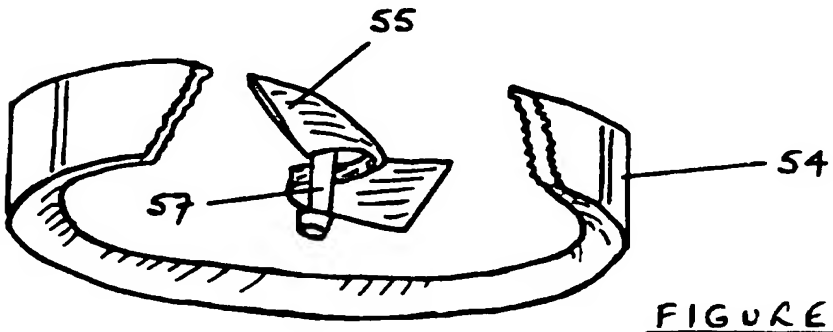


FIGURE 15

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METERING DISPENSER

The present invention relates to a metering dispenser for very viscous liquids or pasty substances.

Typical of such substances are medicinal creams and ointments which, generally, are supplied in a variety of different standard sized tubes. For application to skin, the precise quantity to be applied on each occasion is difficult to control and is rarely stated. Often the physician or pharmacist has to rely upon the patient's commonsense or "rules of thumb" described by an accompanying leaflet. Patients have difficulty in estimating quantities.

Inaccurate dosing may have adverse effects. Potent applications such as steroids or irritants may cause harmful effects if used in excess. On the other hand, inadequate dosing may cause a reduced clinical benefit. Further, there may be financial implications of inaccurate dosing. Ineffective treatment will result in further attendances to the physician and further prescriptions for different treatment. Excessive dosing may result in wastage of cream, or side effects. Pharmaceutical companies are gradually coming under pressure from regulatory bodies to meter viscous topical treatments but have resisted because of the potential expense involved.

A few metering arrangements for very viscous liquids or pasty substances have been described but are either expensive to manufacture or difficult to use. Such prior art arrangements are based on the pump dispenser, the massaging of a collapsible tube, or the syringe principle.

The present invention aims to provide a metering dispenser for very viscous liquids or pasty substances, which will be easy to use and could easily be fitted to any one of a variety of different tubes containing a substance to be dispensed.

The dispenser of the present invention may be used for medicinal creams or ointments where economical and safe dosing is important, but may have many other applications where a cheap metering dispenser for very viscous liquids or pasty substances is required for use by the final user.

Hereinafter in this specification any very viscous liquid or pasty substance with which the present invention may be used is referred to as a "cream".

According to one aspect of the present invention there is provided a metering dispenser for indicating a quantity of cream being dispensed thereby, the dispenser comprising a dispensing passage, means defining at least one pressure surface within the dispensing passage, and an indicator associated with the dispensing passage and movable under the influence of a force arising from contact with the pressure surface of cream being dispensed, when the dispenser is in use.

According to another aspect of the present invention there is provided a metering dispenser for indicating a quantity of cream being dispensed thereby, the dispenser comprising a dispensing passage including a relatively fixed member affording a first seating surface, and an indicator associated with the dispensing passage and movable under the influence of

a force arising from passage of cream being dispensed, when the dispenser is in use; the indicator affording a second seating surface co-operable, in one condition of the metering dispenser, with the first seating surface to form a seal against passage of cream between the seating surfaces and laterally from the dispensing passage.

According to another aspect of the present invention, there is provided a metering dispenser for indicating a quantity of cream being dispensed thereby, the dispenser comprising a dispensing passage including a relatively fixed member affording a first portion of a bearing, and an indicator associated with the dispensing passage and movable under the influence of a force arising from passage of cream being dispensed, when the dispenser is in use; the indicator affording a second portion of said bearing, engaged with the first portion thereof and movable relative thereto to regulate and guide the movement of the indicator relative to the fixed member.

According to yet another aspect of the present invention there is provided a metering dispenser for indicating a quantity of cream being dispensed thereby, the dispenser comprising a dispensing passage and means defining at least one pressure surface within the dispensing passage, the said means including a member rotatable under the influence of a force arising from contact with the pressure surface of cream being dispensed, when the dispenser is in use, the or each pressure surface comprising a vane extending substantially radially of the dispensing passage and having a pitch which differs from point to point along the radial extent of the vane.

Preferably, a plurality of pressure surfaces is defined within the dispensing passage, with at least one such surface being inclined to the longitudinal axis of the passage. Thus, the indicator may be rotatable under the influence of the contact force of the cream upon the pressure surface(s).

Preferably also, the dispenser is constructed to make screw-threaded engagement on an exteriorly screw-threaded nozzle of a standard squeezable tube containing the cream to be dispensed.

In one form of the present invention the indicator is an annular member carrying external markings and whose inner surface at least partially affords the dispensing passage. Disposed within the dispensing passage and extending from the inner wall of the annular member may be a plurality of vanes each providing a pressure surface set at an angle to a longitudinal axial plane passing through the centre of the annular member.

In a second form of the present invention the indicator comprises a plurality of vanes extending radially from a central longitudinal axis of the indicator and terminating at a peripheral band on whose external surface are provided markings. Each of these vanes provides a pressure surface lying in a plane parallel with a longitudinal axial plane passing through the centre of the indicator. Associated with, but separate from, the indicator and upstream thereof in the intended flow direction is a fixed deflector member affording a plurality of vanes each having a pressure surface set at an angle to a longitudinal axial plane passing through the centre of the deflector member.

In both forms the indicator will, in use of the dispenser, rotate in response to the passage therethrough of the cream being dispensed, and the external markings will be visible to a user and will be seen to move, as the indictor rotates, relative to a fixed mark. The external markings on the indicator are provided at equally spaced angular intervals whereby rotation of the indicator through the angular interval defined by an adjacent pair of markings will correspond (subject to certain limitations as outlined below) to the dispensing of a substantially predetermined quantity of cream.

Preferably the dispenser comprises an externally screw-threaded portion for receipt of a standard internally screw-threaded cap. This cap is preferably the cap that closes the nozzle of the tube as supplied and prior to fitting thereto of the dispenser of the present invention.

Preferably the component parts of the dispenser are manufactured from injection moulded plastics materials.

In an embodiment, a dispensing nozzle of the metering dispenser affords a relatively fixed member affording an annular end face which constitutes a first seating surface. The indicator is constituted by an annular member affording an annular end face which constitutes a second seating surface. The indicator further comprises a spindle on the central axis thereof and which is movably received in a socket on the central axis of the dispensing nozzle, forming a bearing. When the metering dispenser is out of use, a closure therefor urges the indicator towards the dispensing nozzle whereby the first and second seating

surfaces come into sealing engagement. Seepage of cream between the seating surfaces and laterally of the dispensing passage is, thus, prevented. When, on the other hand, the metering dispenser is in use and cream is being dispensed through the dispensing passage, force transmitted to the indicator from the cream causes the indicator initially to move axially, within limits controlled by the bearing, i.e. by co-operation between the socket and a retaining portion of the spindle, to open up a gap between the first and second seating surfaces. The indicator is, thus, enabled to undergo relatively unrestricted rotation relative to the dispensing nozzle, under the influence of the force from the cream being dispensed upon the pressure surface(s), or vane(s), this rotation being guided by the bearing, i.e. by rotation of the spindle in the socket.

Preferably, the or each vane has a shape which enhances the smooth flow of cream being dispensed. Such shape includes providing a radially altering vane pitch to counteract the effects, upon the substantially linearly-moving, constant velocity flow of cream as it enters the indicator, of different angular velocities at different radii of the vane. The or each vane preferably also is shaped to guide the cream away from the inner peripheral surface of the indicator in order to reduce or minimize drag thereon.

The metering dispenser of the present invention will now be described in greater detail by way of example only and with reference to the following accompanying diagrammatic drawings which show currently preferred embodiments of the invention and in which:

Figure 1 is an exploded view of a metering dispenser of a first embodiment of the present invention shown in association with the nozzle and cap of a squeezable tube containing a very viscous liquid or pasty substance to be dispensed;

Figures 2A and 2B are, respectively, a cross-sectional side view and a perspective view of the first embodiment of metering dispenser, shown in position on a nozzle of the squeezable tube;

Figure 3 is an exploded view of a metering dispenser of a second embodiment of the present invention;

Figures 4A and 4B are, respectively, an exploded perspective view and an assembled perspective view of the second embodiment of metering dispenser;

Figure 5 is an exploded view of a metering dispenser of a third embodiment of the present invention;

Figure 6 is an exploded cross-sectional view of the third embodiment of metering dispenser;

Figures 7A and 7B are diagrammatic views of two different states of the third embodiment of metering dispenser;

Figure 8 is a perspective view of a detail of the third embodiment of metering dispenser;

Figure 9 is an exploded cross-sectional view of a metering dispenser of a fourth embodiment of the present invention;

Figures 10A and 10B are diagrammatic views of two different states of the fourth embodiment of metering dispenser; and

Figures 11 to 15 show details of some embodiments of the metering dispenser of the present invention.

One aspect of the present invention is based on the concept of converting linear motion of a very viscous liquid or pasty substance as it is dispensed, into rotary motion applied to rotate an indicator having markings which can be viewed in relation to a fixed mark.

Referring now to Figures 1, 2A, and 2B of the accompanying drawings, a very viscous liquid or pasty substance, such as a medicinal cream, is supplied in a standard, squeezable tube T having a standard, externally screw-threaded dispensing nozzle N which is normally closable by a standard, internally screw-threaded cap C. Attachable to the nozzle N in place of the cap C is a metering dispenser D of a first embodiment of the present invention.

This dispenser D comprises an internally screw-threaded attachment member 1 whose screw-thread matches that of the nozzle N. An external surface of the attachment member has a special grip-enhancing form. By this means, the dispenser D may readily be attached to and removed from the nozzle N. Upstanding from the attachment member 1 is an externally screw-threaded tubular dispenser nozzle 2 having a smooth internal surface. A shoulder 7, seen in Figure 2A, is formed internally of the nozzle 2 and acts as a limit stop when it comes into abutment with an end surface of the nozzle N during attachment thereto of the

dispenser D. The dispenser nozzle 2 is also provided with a fixed mark 8 here shown as a arrow directed axially of the nozzle 2 and pointing in the dispensing direction.

The open end of the dispenser nozzle 2 opposite the attachment member 1 is formed internally with an undercut which receives, as a loose retaining fit, a lip 4 depending from the bottom surface of an indicator ring 3. By this means the indicator ring 3 is mounted to the dispenser nozzle 2 for free rotation relative thereto, but is retained against longitudinal displacement therefrom.

The indicator ring 3 is in the form of an annulus having an internal surface provided with a plurality (only four shown) of vanes 5. Each vane 5 affords a pressure surface angled with respect to a respective longitudinal axially extending plane passing through the centre of the annulus. The total surface area of the pressure surface(s) is arranged to be greater than that of the internal surface of the annulus, in order to minimise contact effects between the cream and the internal surface of the annulus reducing rotation of the indicator ring 3.

On its external peripheral surface the indicator ring 3 has a plurality of axial markings 6 spaced at equal angular intervals around the periphery. As more clearly seen in Figure 2B, these markings 6 may be viewed in association with the fixed mark 8 on the dispenser nozzle 2.

In order to seal the dispenser D and tube T when not in use, the cap C may be screw-threadedly engaged upon the dispenser nozzle 2 whose screw thread

substantially matches that of the internal screw thread of the cap C. However, the various screw threads are arranged such that the attachment member 1 will form a tighter fit on the tube nozzle N than the cap C will form on the dispenser nozzle 2. This ensures that the dispenser D will be retained on the nozzle N when cap C is unscrewed from the dispenser nozzle 2.

The dispenser D of this first embodiment thus will be seen to comprise only two parts which may be made from opaque plastics materials.

In use, with the dispenser D installed upon the nozzle N of the tube T, and with the cap C removed, the cream contained within the tube T is extruded therefrom by pressure applied externally to the tube as is well known. The cream passes longitudinally through the nozzle N and the dispenser nozzle 2 till it reaches the indicator ring 3 where it impacts upon the pressure surfaces of the vanes 5. Because the static resistance to circular motion of the indicator ring 3 is less than the pressure exerted on the pressure surfaces of the vanes 5, the indicator ring 3 rotates. In so doing, its external markings 6 can be seen to move relative to the fixed mark 8 and rotation of the indicator ring 3 will be proportional to the amount of cream dispensed therethrough. Because the indicator ring 3 is exposed at the upper end of the dispenser D, it may be "zeroed" by manual rotation prior to commencement of dispensing cream therethrough. To this end, one or more of the external markings 6 may be special "zero" markings.

Satisfactory operation of the dispenser D of this embodiment is based on the following assumptions:

- The density and viscosity characteristics of the cream are relatively constant (i.e. no air pockets in the cream).
- The resistance caused by the indicator ring coming into contact with linearly moving cream being dispensed can be ignored.
- The vane pressure surface areas are constant.
- There is linear, laminar flow of cream.

The resistance to rotation of the indicator ring is small in proportion to the force exerted on the pressure surfaces of the vanes 5 and can therefore be ignored.

The precise details of construction of the metering dispenser D will be determined by the characteristics of cream to be dispensed from the tube T. For example, if the cream has a very low viscosity then the resistance caused by the linearly moving cream coming into contact with the internal surface of the indicator ring will be irrelevant.

However, if the cream has a high viscosity then it may be necessary to have an arrangement whereby the cream will not come into contact with the internal surface of the indicator ring other than the pressure surfaces of the vanes 5, i.e. it will be necessary to leave a gap between the internal surface of the indicator ring and the cream outlet, and to have carefully arranged pressure surfaces which will guide the cream away from the internal surface of the indicator ring 3.

The metering dispenser D of this embodiment is readily assembled from the two separately manufactured parts, and may easily be cleaned.

Simple instructions would be provided for a user and would explain what quantity of cream should be dispensed for use on which surface area of a patient's skin.

With reference now to Figures 3, 4A and 4B of the accompanying drawings, a second embodiment of metering dispenser of the present invention comprises a clear plastics housing H having a lower internally screw-threaded portion 10 for attachment to the nozzle, not shown, of a squeezable tube containing cream to be dispensed and metered, an intermediate portion 11 and an upper portion 12.

An external surface of the housing H is formed with grip-enhancing means to facilitate screwing on to or from the nozzle.

The intermediate portion 11 of the housing H is shaped to receive and immovably retain a deflector member 20.

Deflector member 20 has an external peripheral surface 21 having the shape of part of a frustum of a cone. A correspondingly-shaped internal surface 15 of the intermediate portion 11, together with an internal shoulder 14 formed where the lower and intermediate portions 10, 11 meet, which shoulder 14 is shaped to receive the lower rim 21' of the deflector member 20, ensure that the deflector member 20 will be received and retained as an immovable fit within the housing H.

The space within the external frustoconical surface 21 of the deflector member 20 is generally hollow, but contains a plurality of vanes 22 radiating from a central pillar 23 extending axially of the

metering dispenser. The vanes 22 afford pressure surfaces angled to longitudinal axially aligned planes passing through the centre of the deflector member 20. The deflector member 20 is preferably formed as a unitary plastics moulding.

Provided internally of the lowermost region of the upper portion 12 of the housing H is a smooth-walled, right circular cylindrical surface 16 above which is provided an internal stop 13.

Received within the confines of this lowermost region of the upper portion 12 of the housing H is an indicator ring 30. This is retained against axial displacement by the internal stop 13 and the deflector member 20. However, the indicator ring 30 is free to rotate within the housing H and has an exterior peripheral surface 31 which forms a close, sliding fit with the interior surface 16 of the upper portion 12 of the housing H.

The space within the exterior peripheral surface 31 of the indicator ring 30 is generally hollow, but contains a plurality of diametrical vanes 32 each of which is longitudinally aligned with an axially extending plane passing through the centre of the indicator ring 30. Provided on the exterior peripheral surface 31 are marking 36 spaced at equal angular intervals around the periphery of the indicator ring 30.

A free volume 40 provided within the upper portion 12 of the housing H and above the position of the interior stop 13 affords a settling space.

The metering dispenser of this second embodiment

is used in a similar manner to that of the first embodiment, being attached to the dispensing nozzle of a squeezable tube containing cream to be dispensed and metered. Upon squeezing of the tube, cream passes axially in the direction of the arrow A into the lower portion 10 of the housing H and hence through the spaces between the vanes 22 of the deflector member 20. By virtue of the provision of the angled pressure surfaces of the vanes 22, which remain fixed against any rotation, a rotary motion is imparted to the cream passing thereacross. This rotary motion, combined with the continued axial movement of the cream, results in a helical motion of the cream as it then passes into and through the indicator ring 30.

The rotary component of such helical motion is translated into a rotational force upon the axial pressure surface of the vanes 32, and as a consequence the indicator ring 30 rotates within the housing portion 12. During such rotation of the indicator ring 30 its peripheral markings 36 will be seen to move with respect to a fixed mark 18, here shown as an axially directed arrow whose head points in the dispensing direction, provided on the clear plastic housing H. Thus, in common with the operation of the first embodiment, a metered quantity of the cream may be dispensed.

Cream exiting beyond the indicator ring 30 will have still some rotary component of movement as indicated by the arrows B. In order to remove this component and allow the cream to settle in its motion, it is passed through the settling space 40 from which it eventually emerges with a substantially axial component only of movement as indicated by the arrow E.

At its upper end the housing H terminates in an externally screw-threaded nozzle 17 from which the cream will ultimately be dispensed and which may be closed by an internally screw-threaded cap as described in the first embodiment.

Within the housing H the indicator ring 30 is arranged in close proximity to the deflector member 20 in order to maximize the rotational movement of the indicator ring. Generally there will be a larger number of vanes in the indicator ring 30 than in the deflector member 20 in order to prevent the indicator ring 30 from getting stuck. Depending on the viscosity of the cream to be dispensed, it may be necessary to provide means to prevent any cream from seeping between the exterior surface 31 of the indicator ring 30 and the adjacent interior surface 16 of the upper portion 12 of the housing H, as any such seepage would increase resistance to rotation of the indicator ring 30 and obscure the marking 36 thereon.

The metering dispenser of this second embodiment may easily be assembled from the separately manufactured three clear plastics parts.

It is not possible to "zero" the indicator ring 30 of this embodiment, but its operation is less dependent on the viscosity of the cream being dispensed, and it is more robust than the dispenser of the first embodiment.

As with the first embodiment, simple instructions would be provided and would explain what quantity of any given cream should be dispensed for use on a particular surface area of skin of a patient.

With reference now to Figures 5 to 8 of the accompanying drawings, a third embodiment of metering dispenser of the present invention is seen to comprise an externally screw-threaded dispenser nozzle 50 for releasable attachment to the nozzle, not shown, of a squeezable tube containing cream to be dispensed and metered. An upper end portion of the dispenser nozzle 50 is formed as an annulus 51 bearing an external fixed mark 58 which acts as a datum for determining the metered quantity of cream being dispensed when the dispenser is in use, as in the two embodiments already described.

The annulus 51 affords a mounting for an indicator ring 54. Supported by radial struts 53 (omitted for the sake of clarity in Figures 6, 7A and 7B) within the hollow internal space of the annulus 51 is a central socket member 52. This member has an upwardly-directed opening 52′ aligned with the longitudinal axis of the dispenser nozzle 50 and leading downwards into an enlarged pocket 52′′.

The indicator ring 54 is in the form of an annulus having an internal surface from which extends a plurality of vanes 55, the inner ends of the vanes 55 supporting a spindle 57 which is centrally and axially disposed and depends from the vanes 55 as best seen in Figures 6 to 8. Each vane 55 affords a pressure surface angled with respect to a respective longitudinal axially extending plane passing through the centre of the annulus.

The spindle 57 has a circular head at whose radially-facing peripheral surface the inner ends of the vanes 55 are attached (as best seen in Figure 5), a smooth, axial shank depending from the head, and a

retaining portion 57′ at the lower end of the shank. As best seen in Figures 6 and 8, the retaining portion 57′ has the form of an inverted frustum of a cone and is of enlarged diameter relative to the shank, at least where it adjoins the shank, so as to form a shoulder therewith.

Further, the shank of the spindle 57 of the indicator ring 54 has a diameter slightly less than the internal diameter of the opening 52′ of the socket member 52 of the mounting annulus 51. Also, the retaining portion 57′ of the spindle 57 is sized so as to form a relatively close, smooth sliding fit within the pocket 52′′ of the socket member 52.

The dispenser nozzle 50 and mounting annulus 51 are formed as an integral plastics moulding, and the indicator ring 54 is also formed as a plastics moulding separate from the dispenser nozzle 50 and mounting annulus 51. These two mouldings are assembled together by the spindle 57 with its retaining portion 57′ being aligned with the opening 52′ of the socket member 52 and the mouldings being brought together axially under sufficient pressure to cause the retaining portion 57′ to pass into and through the opening 52′. This is possible, despite the enlarged size of the retaining portion 57′ relative to the opening 52′, due to the resilience of the plastics materials of the respective mouldings. As the retaining portion 57′ enters the pocket 52′′ it snaps into place and thereafter is retained against removal by co-operation between its shoulder and the surface of the pocket 52′′ surrounding the inner end of the opening 52′.

The internal diameter of the annulus of the

indicator ring 54 is somewhat greater than the internal diameter of the mounting annulus 51, as can best be seen in Figures 7A and 7B.

On its external peripheral surface the indicator ring 54 has axial markings 56 spaced at equal angular intervals around the periphery; as in the previously-described embodiments, these markings 56 may be viewed in association with the fixed mark 58 on the mounting annulus 51.

The metering dispenser of the third embodiment operates in the following manner, as will best be understood by referring to Figures 7A and 7B.

Turning, firstly, to Figure 7B, there is shown the state of the metering dispenser when in its out-of-use condition. The dispenser nozzle 50 has been screwed on to the nozzle (not shown) of a squeezable tube of cream to be dispensed and metered, and the screw cap (also not shown) which originally closed the tube's nozzle has been screwed on to the external screw thread of the dispenser nozzle 50 to close the tube and seal the metering dispenser. For exerted downwards (as seen in the Figure) on the indicator ring 54 presses the latter towards the dispenser nozzle 50 so that their mutually facing annular end faces come into close abutment. The retaining portion 57' of the spindle 57 then lies at the lower end of the pocket 52''. In this closed condition of the tube, the contained cream is unable to seep laterally between the mounting annulus 51 and the indicator ring 54.

In order to dispense a metered quantity of the cream from the tube the screw cap is removed from the

metering dispenser and the tube squeezed in well-known manner. The contained cream flows outwards in the direction of the arrow F (shown in Figure 7A), the force exerted on the indicator ring 54 by such flow initially causing the indicator ring 54 to move longitudinally away from the mounting annulus 51. Such movement is within the limits permitted by the sliding of the spindle 57 and retaining portion 57' respectively relative to the opening 52' and pocket 52''. As a result of this movement a gap of width "g" is opened between the mutually facing annular end faces of the indicator ring 54 and mounting annulus 51.

As the cream, flowing through and from the dispenser nozzle 50 in the direction F, impacts upon the vanes 55 of the indicator ring 54 rotation of the latter occurs whereby its external markings 56 move relative to the fixed mark 58 on the mounting annulus 51 thereby indicating the quantity of cream dispensed, as in the previous embodiments.

However, unlike the previous embodiments, the creation and existence of the gap "g" in the in-use condition of the metering dispenser of this embodiment, and the facility for rotation of the indicator ring 54 under the guidance of the spindle 57 in the opening 52', ensure the rotation of the indicator ring 54 proceeds more smoothly due to the reduced drag at the interface between the indicator ring 54 and the mounting annulus 51.

Moreover, due to the difference in internal diameters of the indicator ring 54 and mounting annulus 51 - the latter having the smaller diameter - cream leaving the mouth of the mounting annulus 51 and

entering the indicator ring 54 is disinclined to spread laterally towards the gap "g" or towards the inner peripheral surface of the indicator ring 54. Thus seepage of cream around the exterior of the indicator ring 54 is avoided or minimised, and frictional drag effects of cream as it seeps around, or impinges against, the peripheral surfaces of the indicator ring 54 are considerably reduced compared with the previous embodiments.

Also in this embodiment the length of the straight-sided flow channel within the dispenser nozzle 50 and upstream of the socket member 52 is selected to allow some settling down of the cream following its compression arising from squeezing of the tube.

The metering dispenser of the fourth embodiment of the present invention, a shown in Figures 9, 10A and 10B, is similar to that of the third embodiment and so will not be described in great detail except where it differs therefrom. The socket member 52 in this embodiment is a simple ring supported by struts 53, as may clearly be seen in Figure 9. Another difference lies in the shapes of the mutually facing annular end faces of the indicator ring 54 and mounting annulus 51. These faces are formed by respective surfaces g', g'' which are portions of the surfaces of respective cones and as is clearly shown in Figure 9 these surfaces slope rearwardly and outwardly with respect to the direction of flow F of the cream as it will be dispensed, in use.

The metering dispenser of the fourth embodiment operates in a very similar manner to that of the third embodiment, but with the added advantage that the

rearward slope of the surfaces g', g'' at the gap "g" when the dispenser is in use (Figure 10B) further reduces, or eliminates, any tendency of the cream being dispensed to seep laterally between the indicator ring 54 and mounting annulus 51. Also better sealing at the interfaces is provided in the out-of-use condition (Figure 10A).

Figures 11 to 15 show details of the indicator ring employed in some embodiments of the present invention, and particularly the vanes 55 thereof.

In embodiments of the present invention it is desirable and preferred to employ vanes 55 whose pitch varies with position radially from the axis of the indicator ring. Assuming that, in use of the metering dispenser, cream being dispensed flows into the indicator ring with constant velocity at all points across the flow path, then if the vanes were to have a constant pitch disturbances would arise to the flow of cream. These disturbances would originate from the contact of the cream, flowing with constant velocity, with a vane which, at different radial positions, would be travelling at different angular velocities related to the different lengths of arc being traversed per unit time. Internal forces created in the system would cancel each other out with consequential disturbance to the desired smooth flow of cream.

This effect is avoided, in the present invention, by employing vanes whose geometry may be as indicated diagrammatically in Figure 11 where it is seen that at three different radial positions J, K and L (given by way of example only) the width and pitch of the vane 55 are different. For example, in a typical case of

an indicator ring having an internal diameter of 10mm and a central hub diameter of 2mm the following vane parameters might apply:

- at 5mm from the central hub, (position L), the vane angle is 45°
- at 1mm from the central hub, (position J), the vane angle is 79° (Arctan ($^5/_1$))
- at 3mm from the central hub, (position K), the vane angle is 71° (Arctan ($^3/_1$))

This could be approximated to a linear change of pitch angle with radial position along the length of the vane. Due to this geometry the angle of incidence between the cream and the vane will vary at different radial positions along the length of the vane, counteracting the aforementioned differential velocity effects. Thus, at the extreme outer end of the vane the angle of incidence might be 45°, whilst at the extreme inner end (at the hub), the angle of incidence might be 0°.

The geometry of the vane may also be such that its leading edge slopes upwards (i.e. in the intended direction of flow of the cream being dispensed) and inwards. This may be seen in Figures 11 and 12 (the latter being a perspective view of a single vane and showing different pitches at radial positions M, Q, R similarly to the description given with reference to Figure 11). In these Figures the leading edge is the lower radially extending edge. The aforementioned upward and inward slope may also be appreciated from the perspective view of Figure 8 which shows the underside of the indicator ring.

Such a slope of the vane's leading edge tends to

"guide" the cream being dispensed away from the internal peripheral surface of the indicator ring, so reducing any drag thereon which might otherwise arise.

Another way of enhancing this "guidance" effect of the vanes upon the cream is to give each vane a shape which, when viewed from above (Figures 13 and 14) has two defining arcs of different curvature such that the vane appears to be wider at its extreme outer end and tapers in a curved fashion to its narrower extreme inner end. This appearance arises from the combination of the curvature of the vane with its change in pitch along its radial length. The actual vane shape may best be appreciated from the detail cut-away perspective view of Figure 15 which (for reasons of clarity) shows portions of only two vanes 55 extending from a central spindle 57.

In embodiments of the present invention in which the indicator ring has angled vanes extending radially from a central spindle by which the indicator ring is rotatably retained to a mounting annulus of a dispenser nozzle, it is possible to provide a range of different indicator rings each having vanes of different geometry from that of other indicator rings and to provide for interchangeability of these indicator rings. Thus, the vane pitch of the different indicator rings may be different and, by selecting any desired indicator ring from the range and detachably engaging it with the dispenser nozzle to form a complete metering dispenser (for example, as described above in the third and fourth embodiments), the metering dispenser of the present invention may be adapted for dispensing creams of different viscosities.

The present invention provides a metering dispenser which enables cream being dispensed to be metered cheaply and easily. Furthermore, because the metering dispenser of the present invention is readily attachable to and detachable from a standard squeezable tube, it may readily be cleaned and reused. By provision of the different forms of construction, as described in the different embodiments, selection of that form of construction most suited to a particular cream to be dispensed may readily be made.

The present invention is not limited to the precise details of the currently preferred embodiments as described above, but extends to all such modifications and variations as fall within the broadest statement of the invention contained herein.

Whilst particularly intended for use in dispensing medicinal creams, the metering dispenser of the present invention may be used in a variety of other contexts in which it is required to dispense a closely measured quantity of a very viscous liquid or pasty substance. Such substance need not be contained within a squeezable tube, nor need be dispensed through an externally screw-threaded nozzle, so the metering dispenser of the present invention may be suitably modified in detail to adapt it to the particular context in which dispensing is required.

CLAIMS

1. A metering dispenser for indicating a quantity of cream being dispensed thereby, the dispenser comprising a dispensing passage, means defining at least one pressure surface within the dispensing passage, and an indicator associated with the dispensing passage and movable under the influence of a force arising from contact with the pressure surface of cream being dispensed, when the dispenser is in use.

2. A metering dispenser for indicating a quantity of cream being dispensed thereby, the dispenser comprising a dispensing passage including a relatively fixed member affording a first seating surface, and an indicator associated with the dispensing passage and movable under the influence of a force arising from passage of cream being dispensed, when the dispenser is in use; the indicator comprising a second seating surface co-operable, in one condition of the metering dispenser, with the first seating surface to form a seal against passage of cream between the seating surfaces and laterally from the dispensing passage.

3. A metering dispenser for indicating a quantity of cream being dispensed thereby, the dispenser comprising a dispensing passage including a relatively fixed member affording a first portion of a bearing, and an indicator associated with the dispensing passage and movable under the influence of a force arising from passage of cream being dispensed, when the dispenser is in use; the indicator defining a second portion of said bearing, engaged with the first portion thereof and movable relative thereto to regulate and guide the movement of the indicator

relative to the fixed member.

4. A dispenser according to claim 1, 2 or 3, wherein a plurality of pressure surfaces is defined within the dispensing passage, with at least one such surface being inclined to the longitudinal axis of the passage.

5. A dispenser according to any preceding claim, wherein the indicator comprises an annular member whose inner surface at least partially defines the dispensing passage.

6. A dispenser according to claim 5, wherein the annular member has external markings.

7. A dispenser according to claim 5 or 6, wherein a plurality of vanes disposed within the dispensing passage, extend from the inner surface of the annular member, each vane providing a pressure surface set at an angle to a longitudinal axial plane passing through the centre of the annular member.

8. A dispenser according to any of claims 1 to 4, wherein the indicator comprises a plurality of vanes extending radially from a central longitudinal axis of the indicator and terminating at a peripheral band.

9. A dispenser according to claim 8, wherein the external surface of the peripheral band has markings.

10. A dispenser according to claim 8 or 9, wherein each vane provides a pressure surface lying in a plane parallel to a longitudinal axial plane passing through the centre of the indicator.

11. A dispenser according to claim 8, 9 or 10, wherein a fixed deflector member is associated with the indicator upstream thereof in the intended flow direction of the cream and provides a plurality of vanes each having a pressure surface set at an angle to a longitudinal axial plane passing through the centre of the deflector member.

12. A dispenser according to claim 11, wherein the fixed deflector member is separate from the indicator.

13. A dispenser according to any of claims 7 to 12, wherein the shape of the or each vane provides a radially altering vane pitch, to counteract the effects of different angular velocities of cream at different radial distances along the vane upon the substantially linearly-moving, constant velocity flow of cream as it enters the indicator.

14. A dispenser according to any of claims 7 to 13, wherein the or each vane is shaped to guide the cream away from the inner peripheral surface of the indicator, to reduce or minimise drag thereon.

15. A dispenser according to any preceding claim, wherein external markings on the indicator are provided at equally spaced angular intervals, whereby rotation of the indicator through the angular interval defined by an adjacent pair of markings corresponds to the dispensing of a substantially predetermined quantity of cream.

16. A dispenser according to claim 15, wherein the external markings are visible to a user and are movable, as the indicator rotates, relative to a fixed mark.

17. A metering dispenser for indicating a quantity of cream being dispensed thereby, the dispenser comprising a dispensing passage and means defining at least one pressure surface within the dispensing passage, the said means including a member rotatable under the influence of a force arising from contact with the pressure surface of cream being dispensed, when the dispenser is in use, the or each pressure surface comprising a vane extending substantially radially of the dispensing passage and having a pitch which differs from point to point along the radial extent of the vane.

18. A dispenser according to any preceding claim including a dispensing nozzle constituting a relatively fixed member providing an annular end face defining a first seating surface and an annular member constituting the indicator and providing an annular end face defining a second seating surface, the first and second seating surfaces being able to be brought into sealing engagement with one another when the dispenser is out of use, whereby any seepage of cream between the seating surfaces and laterally of the dispensing passage is prevented or at least substantially reduced.

19. A dispenser according to claim 18, wherein the indicator further comprises a spindle on the central axis thereof, which spindle is received movably in a socket on the central axis of the dispensing nozzle, such that, when the dispenser is out of use, a closure therefor urges the indicator towards the dispensing nozzle, whereby the first and second seating surfaces are brought into sealing engagement with one another.

20. A dispenser according to claim 19, wherein axial

movement of the spindle within the socket is limited.

21. A dispenser according to claim 20, wherein limited axial movement of the spindle is controlled by cooperation between the socket and a retaining portion of the spindle.

22. A dispenser according to any of claims 18 to 21, wherein, in use of the dispenser, a gap between the first and second seating surfaces is provided on initial axial movement of the indicator.

23. A dispenser according to any preceding claim, including means arranged to make screw-threaded engagement on an exteriorly screw-threaded nozzle of a standard squeezable tube containing cream to be dispensed therefrom.

24. A dispenser according to any preceding claim, including an externally screw-threaded portion for receipt of a standard internally screw-threaded cap.

25. A metering cream dispenser substantially as hereinbefore described with reference to the accompanying drawings.

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Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9517162.5
Relevant Technical Fields (i) UK Cl (Ed.N) B8N NJD, NKL, NL, NHCC (ii) Int Cl (Ed.6) G01F 1/05, 1/07, 1/10, 1/11, 1/28	Search Examiner MR S WALLER Date of completion of Search 26 OCTOBER 1995
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE: WPI	Documents considered relevant following a search in respect of Claims :- 1, 4-16, 18-25

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X	EP 0362784 A2 (HYDAC TECHNOLOGY) see Figure and Derwent Abstract	1

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